3.1 Earth

3.1.1 Existing Conditions

3.1.1.1 Geology

Location and Physiography

The proposed Wallula Power Project would be located within the Columbia Plateau physiographic province of southeastern Washington and northeastern Oregon. This province encompasses an area of approximately 78,000 square miles, centered roughly around the Tri-Cities area in southeastern Washington. The power plant would be located in the southeastern part of the Pasco Basin, whereas the proposed 33-mile-long transmission line right-of-way would extend southwesterly into Oregon, roughly paralleling the Columbia River to the vicinity of McNary Dam.

The major physiographic features in the project area include the Columbia River, the rolling dune lands (now primarily converted to agriculture by irrigation) to the east of the community of Wallula, the Walla Walla River (a major tributary to the Columbia), Wallula Gap, the Horse Heaven Hills, and the McNary Potholes of the Wanaket Wildlife Area.

Geologic processes that have shaped the landscape of the region include vast outpouring of basaltic lava flows in Miocene time, tectonic folding and faulting during the last several million years, sediment deposition and erosion along the ancestral and current Columbia River, Late Pleistocene catastrophic glacial outburst floods, and Late Pleistocene and Recent eolian (windblown) erosion and deposition of silt and fine sand.

Ongoing folding and faulting since Miocene time has shaped the main elements of the landscape. The anticlinal ridges and synclinal valleys that characterize the region began developing about 16 million years ago. In contrast, the lowland surfaces of the project area have been shaped predominantly by surficial geologic processes. In particular, Late Pleistocene catastrophic glacial outburst floods stripped the soil and unconsolidated materials from the landscape in some areas, leaving large tracts of barren basalt bedrock and a network of deeply eroded channels, and rapidly deposited thick accumulations of sediments in some low lying areas along the floodways.

The entire Columbia Plateau was affected by either wind erosion or deposition during the Pleistocene, although the Palouse region to the east of the plant site is particularly well known for deep and fertile soils, or loess, which formed by deposition of windblown silts and fine sands. North and east of the Columbia River, this long-term process has created rolling ridges and troughs. Windblown sediments also underlie much of the proposed transmission line corridor to the southeast and south of the Columbia River between the proposed plant and McNary Dam. The project area includes both partially-stabilized to stabilized dunes as well as active dune lands that are mobilized by the strong southwesterly winds that blow through the region in the later summer and fall.

Regional Stratigraphy

The Columbia Plateau is underlain by a thick sequence of flood basalts that are known collectively as the Columbia River Basalt Group. These lava flows were erupted from fissures between 6 and 16.5 million years ago and rapidly flowed over vast tracts of eastern Washington and adjoining parts of Oregon and Idaho. More than 50 different major Columbia River Basalt flows have been identified, including individual flows ranging in thickness from a few inches to more than 300 feet. Many of the flows are interbedded with Miocene to Pliocene age volcaniclastic and fluvial sedimentary deposits (Myers et al. 1979).

Following extrusion of the Columbia River Basalt Group, relatively thick sedimentary deposits accumulated on the basalt surface, primarily in the lower-lying areas. From oldest to youngest, these sediments include a relatively thick sequence of the Miocene to Pliocene age fluvial deposits known as the Ringold Formation; the overlying Late Pleistocene age Pasco Gravel and Touchet Beds of the Hanford Formation; and Pleistocene to Recent eolian and alluvial deposits.

The Pasco Gravel and Touchet Beds were deposited in the Late Pleistocene time when enormous volumes of water were released as outburst floods from glacial Lake Missoula. As these floods crossed eastern Washington, they eroded a system of deeply scoured coulees, which are generally referred to as the Channeled Scablands. The floodwaters stripped the soil and unconsolidated sediment from much of the floodway, and deposited it farther downstream along major river valleys and drainage channels as massive flood deposits (such as huge point bars and backwater deposits). These flood deposits now form depositional terraces along the Columbia, Snake, and Walla Walla River Valleys.

The volume of water that crossed the Columbia Plateau during the floods was too great to pass readily through some narrow water gaps. As a result, temporary lakes formed and suspended sediment and bedload from the floodwaters was deposited. The largest of these short-lived lakes formed upstream of a topographic restriction of the Columbia River Valley at Wallula Gap. The coarser sediments from these floods (Pasco Gravel) were deposited along the main stream channels, and the finer grained sediments (Touchet Beds) settled out of the stagnant flood waters that temporarily occupied the smaller tributaries and higher ground. These fine grained deposits now form terraces on the uplands and along the smaller tributary valleys.

Once the floods had waned, large tracts of land covered by silts and sands were exposed. These unconsolidated sediments were then eroded by wind and transported northeastward where they were redeposited in the uplands as a series of rolling dune ridges and troughs. This process continues today, although at a reduced rate, because much of the dune land has been stabilized or partly stabilized as a result of agricultural practices during the last few decades.

Regional Geologic Structure

The project area is situated near the western end of the Walla Walla Basin and near the southeastern extent of the Pasco Basin, both of which are structural depressions with centers under the Walla Walla and Tri-Cities areas, respectively. As illustrated in Figure 3.1-1, these basins are separated by two major fold belts. One of these is the northwest-trending Rattlesnake-Wallula lineament, which includes the Horse Heaven Hills anticline, the Umatilla syncline, and Wallula fault zone in the project area. The Rattlesnake-Wallula lineament is part of the Olympic-Wallowa lineament (OWL), a linear topographic feature that extends several hundred miles from western Washington to northeastern Oregon. Although the OWL is made up of a variety of aligned structural features, whether it represents a continuous structural zone is not known; its origin and structural significance are still under debate (Reidel et al. 1994, Reidel and Tolan 1994, Mann and Meyer 1993).

The Rattlesnake-Wallula lineament is juxtaposed on the second fold belt, a westward-trending system that includes the Walla Walla syncline to the east and a series of anticlinal ridges and broad synclinal valleys to the west.

The anticlinal ridges and intervening synclinal valleys in the region formed concurrently with the deposition of the Columbia River Basalt flows, and have continued to develop after volcanism ceased about 6 million years ago. This deformation resulted in as much as 3,000 feet of structural relief in the past 10 million years, with the rate of subsidence and fold growth decreasing from Miocene (16 million years ago) to Holocene time (the last 10,000 years) (Reidel et al. 1994). After the volcanism had ceased, the subsiding areas became depositional centers for accumulation of fluvial sediments of the Ringold Formation and the flood deposits of the Pasco Gravel and Touchet Beds.

Reverse or thrust faults typically occur on the over-steepened north limbs of the larger anticlines in the project area. Several of these faults are believed to have been active within Quaternary and/or Holocene time, including the faults along Toppenish Ridge (Noson et al. 1988, Reidel et al. 1994), the Saddle Mountains anticline (West et al. 1996), and the Hite fault (Reidel and Tolan 1994). The closest mapped fault to the plant site is the Wallula fault zone, which is located approximately 4.5 miles to the southwest, immediately south of the Walla Walla River. This fault zone bounds the north limb of the Horse Heaven Hills anticline and forms the portion of the OWL that extends southeastward from Wallula Gap. Two fault segments within the Wallula fault zone appear to have moved in Holocene time, and several others have evidence of Pleistocene movement (Reidel et al. 1994).

Seismicity (Earthquakes)

The largest known historical earthquake in the region, which occurred in 1872 along an unidentified shallow fault in the North Cascades, had an estimated magnitude of 7.3 (Noson et al. 1988). Apart from this major earthquake, most of larger historic seismic events in the state have occurred west of the Cascade Mountains, and primarily in the Puget Sound region. Epicenters of the larger historic earthquakes in the Pacific

Northwest are shown in Figure 3.1-2 (see Appendix C, Table C-1 for further details on these earthquakes). The distribution of the larger historical earthquakes that have been recorded in the Columbia Plateau region is shown in Figure 3.1-3.

Most of the seismic activity in eastern Washington occurs as microearthquake swarms (DOE 1987, Tillson 1989). These swarm events are generally of small magnitude (normally less than magnitude 3.5), although occasionally a swarm earthquake can be somewhat stronger. A swarm can consist of over 100 earthquakes that are closely spaced and occur over a relatively short time of days to months. They occur at shallow depths, normally in the range of 3 to 5 kilometers. Concentrations of swarms have occurred in the vicinity of Saddle Mountains on the north margin of the Pasco Basin, and in the Walla Walla Basin. The closest area of earthquake swarms to the project site is at Wooded Island, about 30 miles northwest of the site.

The largest historic earthquake within a 100-mile radius of the proposed project was the Milton-Freewater earthquake of July 16, 1936 (Tillson 1989). This earthquake had a maximum intensity of approximately VII, an estimated magnitude of 6.1, and was felt over an area of 105,000 square miles. This quake was centered at Milton-Freewater on the Washington-Oregon border, about 25 miles to the southeast of the project site. There is disagreement in the literature as to whether this earthquake occurred on the Wallula fault zone, or on the intersecting northeast-trending Hite fault zone (Reidel et al. 1994, Reidel and Tolan 1994, Mann and Meyer 1993, 1994). The 1936 earthquake reportedly caused changes in spring discharge and localized liquefaction and ground cracking west of the town of Umapine, Oregon (Mann and Meyer 1993). It is not known whether the cracks formed as surface fault ruptures or as a result of ground failure due to liquefaction and shaking (Reidel et al. 1994).

Another relatively large earthquake within the region was a magnitude 4.4 event in 1918 near the town of Corfu, Washington. This earthquake occurred north of the Saddle Mountains anticline in the vicinity of the Royal Slope microearthquake swarm (Tillson 1989), approximately 65 miles north of the plant site. This earthquake reportedly triggered landsliding on a steep slope near the epicenter.

Maps of the seismic activity within the region (Reidel et al. 1994) show a lack of both macro- and microseismicity around the project area. The closest seismic events, with magnitudes ranging from 3.5 to 4.0, have been more than 6 miles from the project site, near the towns of Pasco and Reese (Tillson 1989). Based on the seismic history and the structural geology of the area, there is a potential for moderate to strong ground shaking at the project site, but there is a very low potential that fault rupture would occur.

Geologic investigations suggest that some of the active faults near the Pasco Basin may be capable of large earthquakes. West (1996) concluded that the Saddle Mountains fault, located approximately 60 miles north of the project site, is capable of a magnitude 7.0 event. Also, active portions of the Wallula fault zone, such as the fracture that probably ruptured during the 6.1 Milton-Freewater event, may be capable of a similar magnitude earthquake.

Based on the relative risks associated with all potential earthquake sources in the region, a probabilistic seismic hazard analysis was performed to develop the design earthquake for the project. The seismic design criteria of magnitude 7.0, with a peak ground acceleration of 0.22 g, includes the relative and proportionate risks from all identified seismic source zones.

Project Area Geology

Plant Site

The plant site is situated near the east bank of the Columbia River, about 7 miles downstream of the confluence of the Columbia and Snake Rivers and 4.5 miles upstream of the confluence of the Columbia and Walla Walla Rivers. The site is situated on a gently rolling terrace that slopes generally southwestward toward the river, as portrayed on the topographic map of the plant site vicinity (Figure 3.1-4).

The plant site is underlain by between 6 and 50 feet of unconsolidated sand, silt, and gravel that has been mapped by Myers et al. (1979) as Pasco Gravel (see Figure 3.1-5). These sediments were deposited primarily during the last major catastrophic flood released from glacial Lake Missoula about 13,000 years ago. As shown in a site subsurface geologic profile (Figure 3.1-6), the Pasco Gravel at the site consists of an upper zone of poorly graded, loose to dense, fine to coarse sand and silt with some gravel, and a lower zone of very dense sandy, coarse gravel and boulders.

The flood deposits of the Pasco Gravel were deposited on an irregular surface formed on the relatively gently dipping lava flows of the Saddle Mountains Basalt Formation (Figure 3.1-7). This basalt formation, which is the uppermost of the major Columbia River Basalt Group flow units in the project area, consists of a series of four lava flows and interbedded volcaniclastic and fluvial sedimentary deposits. Collectively, the Saddle Mountains Basalt is locally over 850 feet thick, and overlies older lavas of the Columbia River Basalt Group. Within the Saddle Mountains Basalt, the uppermost lithologic unit is the Ice Harbor Flow. This flow consists primarily of hard, brown to dark gray basalt, and is approximately 100 feet thick below the site. It overlies the Levey interbed, which locally consists of about 50 feet of volcaniclastic claystone and sandstone.

Within a few hundred feet to the east and upslope from the site, the surface deposits consist of fine to medium-grained sands and silts that were deposited as dunes beginning in Pleistocene time. These eolian deposits overlie unconsolidated to weakly consolidated fluvial sands, gravels, and cobbles of the Pliocene-age Ringold Formation. As shown in Figure 3.1-8, the Ringold sediments to the east of the site unconformably overlie gently dipping basalt flows and sedimentary interbeds of the Saddle Mountains Basalt.

Pipelines

Most of the proposed water line and natural gas pipeline would be constructed in areas mantled by stabilized dune deposits of unconsolidated silt and fine to medium sand. The exceptions to this would be within approximately 0.5 mile south of the plant site where both pipelines would traverse surficial deposits composed of silty sand and gravel of the Pasco Gravel, and possibly in some small areas where active dunes may be crossed. Based on limited subsurface data from water well logs, unconsolidated sands and gravels of the Pasco Gravel and the older weakly consolidated sands and gravels of the Ringold Formation underlie the dune deposits along the alignment. Collectively, these sediments are typically at least 80 feet thick overlying the Saddle Mountains Basalt bedrock, with the depth to rock increasing to over 150 feet at the south end of the proposed water pipeline (Figure 3.1-7).

Transmission Line and Associated Facilities

In general, the Holocene dune sand deposits form much of the rolling terrain for the northern segment of the proposed transmission line corridor north of the Walla Walla River. North of the Walla Walla River, the geology is similar to that described above for the pipeline laterals. The right-of-way drops gradually southward from the dune land topography into the Walla Walla River Valley where it would cross the river at an elevation of approximately 350 feet MSL. The valley is approximately 1,400 feet wide in this location and is underlain by Holocene floodplain alluvium composed primarily of silts and fine sands overlying Late Pleistocene outburst flood deposits composed of both fine grained Touchet Beds and Pasco Gravel.

From the Walla Walla River southward, the transmission lines would climb the steep north face of the Horse Heaven Hills, gaining about 1,200 feet in elevation over a distance of about 0.25 mile. This steep slope consists primarily of basaltic bedrock outcrop and corresponds to the surface trace of the Wallula fault zone and the north flank of the Horse Heaven Hills anticline. From the crest of the Horse Heaven Hills, the transmission lines would traverse a high plateau of gently to steeply rolling terrain that slopes relatively gently southwestward for about 7 miles to the vicinity of Juniper Canyon. The geology of this section of the right-of-way is dominated by the thick sequence of relatively resistant basalt flows and a mantle of unconsolidated sediments ranging from relatively thin residual soil and windblown silt and sand to thick accumulations of windblown sand. Numerous exposures of the Columbia River Basalt Group are evident on steeply cut slopes and in drainages that cut the plateau. The largest such drainage in this area is Spring Gulch, which is about 0.25 mile wide and 300 feet deep at the right-of-way crossing.

Juniper Canyon is an east-trending canyon incised about 400 to 600 feet into the southwest sloping plateau. The terrain on either side of the canyon slopes steeply toward it across a distance of about 0.5 mile along the right-of-way. The lower steep canyon walls are composed primarily of basalt, whereas thick accumulations of windblown silt and sand underlie the upper canyon slopes, particularly on the south canyon wall. These sediments are weakly consolidated to unconsolidated, and on the steeper slopes they are marginally stable, as evidence by numerous landslides and sand blowouts on the south canyon wall.

Southwest of Juniper Canyon, the terrain along the right-of-way continues to decrease in elevation and is underlain by a relatively thick sequence of sand and silt that was deposited by the Late Pleistocene outburst floods, and is capped with a veneer of windblown silts and sands. Basalt is exposed in a few places, apparently where it was too high to be overridden by the flood deposits. At the west end of the proposed transmission line near the town of Umatilla, the terrain is flatter, is crossed by several small intermittent and perennial drainages, and is covered in places by the small ponds of the McNary Potholes area. The surface geology in this area is characterized by a mixture of relatively thin fluvial and lacustrine deposits overlying basalt, interspersed with areas of basalt exposure.

3.1.1.2 Soil

Plant Site and Pipelines

Soil types were identified by the U.S. Department of Agriculture (1964) at the plant site and along the pipeline routes. The plant site and pipeline laterals are located within four different soil-mapping units, which have the following general properties. Further details about these soils can be found in Appendix C, Table C-2.

- Active Dune Land – This land type consists of low, rounded, or dune-shaped hills and long, narrow ridges of windblown sand (i.e., longitudinal dunes) that have little to no vegetative cover to protect them from wind or water erosion. The dunes have a local relief of up to 25 feet and are a mile or more in length oriented in a northeasterly direction. Much of the dune lands has been modified in the last several decades by agriculture and irrigation activities. At the project site, the areas within this land type no longer maintain the characteristics of the dune lands; rather, they are similar in nature to the partially stabilized and stabilized soil units described below. The dunes are extremely erodible from both wind and precipitation.
- Quincy Soil Series – The Quincy soils are coarse-textured soils that developed in windblown materials that have been reworked as valley fills and/or stream outwash. The Quincy soils are found on terraces and streams bottoms, and are excessively to somewhat excessively drained.
- Adkins Soil Series – This soil series consists of deep, well-drained, loamy fine sand. The physical characteristics of this soil series are similar to those of the Quincy series but differ in the origin of the parent material. The Adkins soil is predominantly a silty-sand mixture with 25 to 35% fines and is up to 26 inches deep. It is of similar alkalinity to the Quincy soils and has low shrink-swell potential. Only small areas of the Adkins Series soils occur along the pipeline alignment.
- Hezel Soil Series – The Hezel Series is similar in physical characteristics to the Adkins and Quincy Soil Series, but differs in that it is generally developed over

calcareous silt and sand of the slackwater flood deposits of the Touchet Beds. The Hezel Soil Series is predominantly a silty-sand mixture with 25 to 35% fines. It is slightly more alkaline than the Quincy soils, up to 20 inches deep, and has low shrink-swell potential.

Based on soils mapping by the Natural Resources Conservation Service (NRCS), the soils at the project site and along the pipeline routes have high permeability and are well drained. Infiltration rates recently measured on the site ranged from 1.5 to 3.0 inches per hour (GeoEngineers 1997). The soils are mildly to moderately alkaline, highly erodible, and have low shrink-swell potential.

The dune-type soils on the upland areas east of the Columbia River Valley occur in southwest-trending linear bands. Where the pipeline alignments would leave the project site, the soils are mapped as various units of the Quincy Complex. Quincy Complex soils extend along the initial southward leg of the proposed pipeline to Wallula Junction. This portion of the pipeline alignment crosses one narrow segment of Adkins soil at the mouth of the dry wash. The Adkins soils are similar to the Quincy soils, except they are developed in windblown materials on high river terraces.

Quincy soil units underlie the majority of the pipeline routes, with Adkins soil units as the second most abundant soil type. Although the Adkins soils (and some of the Quincy soils) are mapped as active dune land, the soil mapping predates much of the agricultural development of this area. Therefore, this mapping does not reflect that much of area once occupied by active dunes has been stabilized as a result of irrigation.

Transmission Line and Associated Facilities

The soils exposed along the transmission line right-of-way are generally very similar to those described for the plant site and pipeline routes. The majority of these soils consist of moderately deep to deep, well-drained sand, silt, and silty sand. However, some additional shallow, well-drained and deep, poorly drained sands and bedrock outcrop soil series are also present. Most of the soils crossed by the right-of-way are suited for irrigated and non-irrigated cropland, rangeland, and pastureland.

The soil unit characteristics, including general composition, slope, erosion potential, land capability, and permeability are summarized in Appendix C, Table C-3.

3.1.1.3 Topography and Unique Features

Generation Plant and Pipelines

The topography of the plant site and natural gas and makeup water supply pipeline routes is illustrated on Figure 3.1-4. The plant site is situated in the Columbia River Valley, about 800 feet east of the river. This section of the Columbia River is impounded behind McNary Dam, approximately 25 miles downstream, and is known as Lake Wallula. The Columbia and Walla Walla Rivers drain the area. Most of the smaller streams or drainages in the area are intermittent, flowing only during periods of heavy rainfall or melting snow. An incised dry wash is located about 3,000 feet southeast of the plant site. This channel was apparently eroded in Pleistocene time during catastrophic flooding; it now only contains surface water during periods of heavy precipitation or snowmelt.

The project site slopes generally from the northeast (approximately 406 feet in elevation) to the west and southwest (approximately 360 feet in elevation). Average grade is approximately 1.5%, with maximum slope gradients reaching 6%. The site topography is gently rolling, with the long axis of the rolls oriented southwest to northeast. Drainage is to the southwest toward the Columbia River. A railroad embankment marks the east property line.

The area of the proposed water and natural gas pipelines is characterized by gently to moderately rolling hills with slopes of less than about 15%. The first half mile of the pipeline alignments follows the east side of the Columbia River Valley and is relatively level. At about 0.75 mile south of the plant site the pipelines would cross a dry wash at about elevation 370 feet MSL, the lowest section along the route. From there, they would climb the slope to the southeast to reach elevations ranging from 400 to 440 feet MSL. At about 2 miles south of plant site, the pipeline alignments would diverge, with the water pipeline continuing southward at much the same elevation and topography as farther to the north. The natural gas pipeline would turn east-southeastward, crossing rolling uplands for about 6 miles to its terminus, reaching elevations of 600 feet.

Transmission Line and Associated Facilities

The northernmost segment of the transmission line right-of-way would begin at the generation plant site and extend to the proposed Smiths Harbor Switchyard east of the community of Wallula. This area has gently to moderately rolling topography with slopes generally less than 15%. Southward from the proposed switchyard the right-of-way would generally follow the existing Lower Monumental–McNary transmission line, crossing the partially irrigated rolling dune lands with elevations ranging from 420 to 500 feet MSL, and local relief of about 80 feet. The right-of-way then slopes southward into the Walla Walla River Valley where it crosses the river at an approximate river elevation of 350 feet MSL.

Southwest of the Walla Walla River, the transmission line would cross the Wallula fault zone and climb the steep north-facing slope of the Horse Heaven Hills to approximately 1,600 feet MSL, where the terrain is flatter, forming an undulating plateau upon which most of the land is under cultivation. The proposed transmission line would continue to the southwest down and over the gently sloping southwest limb of the Horse Heaven Hills anticline. This sloping terrain is interrupted by west-draining tributaries that are incised into the plateau and expose basalt flows under the relatively thin sediment cover. Spring Gulch is one of the more prominent of these drainages.

About 13 miles southwest of the crest of the Horse Heaven Hills, the plateau is incised by the roughly 2,000-foot-wide and 400-foot-deep Juniper Canyon. To the southwest of Juniper Canyon, the terrain along the right-of-way continues to slope gradually westward. The land in this area is not under cultivation, perhaps owing to sandier, less productive soils. A significant portion of this area has been burned during a recent wildfire. Basalt ridges overlain with thin blankets of sand and sparse vegetation characterize the land west of the burned area. As the right-of-way traverses farther to the west, steep jagged basalt outcrops are abundant until a relatively flat marshy area is reached. The McNary Potholes area, located farther west, is formed near the axis of the Umatilla syncline.

3.1.1.4 Unique Features

There are no unique geologic or topographic features associated with the project site, the water and natural gas pipeline routes, or the transmission line and switchyard site.

3.1.1.5 Erosion

Erosion is the breakdown and transport of soils and bedrock by natural processes including water, wind, and glaciation. The susceptibility of any material to erosion depends upon chemical and physical characteristics (e.g., cohesion); topography; amount and intensity of precipitation and surface water; intensity of wind; and type and density of vegetation, if present. Enlargement of land area (accretion) may occur as a result of the natural actions of water, wind, and mass wasting.

The project site and pipeline laterals would be located in an arid region of low annual precipitation with relatively low associated runoff potential. Eolian (wind) processes previously dominated the morphology of the ground surface over much of the plant site, pipeline laterals, and transmission line right-of-way. Agricultural activities and irrigation have largely stabilized or partially stabilized much of the terrain near the plant site, pipeline laterals and the northern half of the transmission line right-of-way; however, much of the terrain southward from Juniper Canyon to the Potholes area is not under cultivation and is relatively sensitive to wind erosion.

The assessment of erosion potential is principally based on the erosion potential specified for surface soils by the NRCS. The NRCS uses an erosion factor “K” to indicate the susceptibility of a soil to sheet and rill erosion by water. This is one of the six factors used in the Universal Soil Loss Equation to predict the average annual rate of soil loss by sheetwash and rill erosion. The values of K range from 0.05 to 0.69, with higher K indicating more erosion susceptible soil. K values below 0.13 are considered to have low erosion potential; values in the range of 0.13 to 0.26 are considered medium; and soils with values greater than 0.26 are considered highly susceptible to erosion.

The effect of wind erosion is given by grouping the soils into different wind erosion groups. The NRCS uses wind erosion groups to indicate the susceptibility of soil to wind erosion and the amount of soil lost. Wind erosion groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. A description of the wind groups and K values for each soil type in the project area is provided in Appendix C, Table C-4.

Regional Conditions

Flood Erosion

Flood erosion is potentially an important process on lower elevations of the project area near drainage channels. Lake Wallula water levels in the project area are controlled at McNary Dam downstream of the project site, and by a series of dams along the mid-Columbia River and Snake River upstream of the proposed project. The lake level is raised and lowered in response to seasonal flows and water use requirements.

The Walla Walla River is the only location along the transmission line right-of-way where major flooding could occur. However, because of the proximity of the lower Walla Walla River to Lake Wallula, water levels in the vicinity of the proposed crossing are primarily controlled at McNary Dam, downstream of the project area. The lake level is raised and lowered in response to seasonal flows and water use requirements. In times of severe storms (such as December 22, 1964), floodplain inundation is controlled by precipitation-generated runoff in the watershed.

Water Erosion

Precipitation can remove soil materials through overland flow, sheet wash, or rain splash. Rain splash acts on soils that are exposed at the surface, especially when these soils are located on a slope. Overland flow or sheet wash occurs when the near-surface soil on sloping ground reaches saturation. Generally, the low rainfall and the presence of widespread croplands limit the amount of erosion that can occur in the region. However, because most of the soils in the region are moderately to highly erosive, there is a potential for significant localized erosion where the land is undeveloped or surface water runoff is not controlled.

Wind Erosion

Wind is a very active agent of erosion in the project area. The strong and pervasive southwesterly winds during the summer and fall are continuously winnowing silt and fine to medium sand and transporting the sediment eastward. Because most of the soils in the region are moderately to highly susceptible to wind erosion, under natural conditions, almost all of the project areas would be potentially susceptible to wind erosion, especially during heavy winds. However, the plant site and most of the pipeline laterals would occupy areas that are under irrigated cultivation. As a result, the land surface in these areas is currently relatively well protected from wind and other erosion processes by the vegetation cover that is maintained by irrigation. Similarly much of the land along the transmission right-of-way is cultivated, although wind erosion is pervasive along existing transmission line access roads.

Project Conditions

Plant Site

The erosion factors (K-values) for soils at the plant site range from 0.15 to 0.32. These values indicate that there is a moderate to high potential for water-caused erosion. Most of these soils are also highly to very highly susceptible to wind erosion when protective vegetation is disturbed, removed, or killed. Similarly, bare ground would be susceptible to erosion by surface runoff in the event of intense precipitation (summer cloudbursts) or rapid snowmelt.

Pipelines

The makeup water supply pipelines would traverse stabilized, partially stabilized, and possibly active dune lands. The K-values for the soils encountered along the proposed pipeline laterals range from 0.15 to 0.37. These erosion factors indicate that there is a moderate to high potential for water-caused erosion. As with the project site soils, most soils along the proposed pipeline laterals are also highly to very highly susceptible to wind erosion, especially when protective vegetation is disturbed, removed, or killed.

The active dune lands have a high susceptibility to rapid erosion and accretion as the dunes shift in shape and location. The dunes are known to bury roadways and expose buried pipelines, a process that can occur quickly (hours to days). Much of the former active dune area has been planted, substantially reducing the activity of the dunes. Consequently, dune land erosion and accretion would be expected to affect the pipeline route only in areas that are not currently under cultivation.

Transmission Line and Associated Facilities

The erosion factors (K-values) for most soils along the transmission line right-of-way range between 0.15 and 0.32 (USDA 1964, 1984). These values indicate that there is a moderate to high potential for water-caused soil erosion. Most soils found in the right-of-way are also highly to very highly susceptible to wind erosion when protective vegetation is disturbed, removed, or killed. Similarly, bare or sparsely vegetated ground would be susceptible to erosion by surface runoff in the case of intense precipitation (cloudburst) or rapid snowmelt.

Stabilized, partially stabilized, and possibly active dune lands are present along the northern and southwestern sections of the transmission line right-of-way. The K-values for the soils encountered along the route range between 0.15 and 0.37 (USDA 1964). These erosion factors indicate that water-caused soil erosion has a moderate to high potential. These soils are also highly to very highly susceptible to wind erosion, especially when protective vegetation is lacking or disturbed. Along the northern part of the transmission line right-of-way, most of the former active dune lands are now planted and irrigated, so dune land processes would be expected only in small areas. However, large areas along the right-of-way to the southwest of Juniper Canyon are undeveloped or have been recently burned by wildfire, leaving soils relatively unprotected from erosion.

3.1.2 Impacts of the Proposed Action

The potential for impacts to geology and soils is primarily a function of the project area's susceptibility to seismic hazards and to long-term degradation. Potentially significant seismic impacts, primarily during operation of the project, include strong ground shaking, liquefaction, lateral spreading, and slope instability. Other hazards associated with ground conditions include frost heave, expansive soils, and subsidence. Long-term degradation would most commonly result from disruption of near-surface soils. The potentials for seismic impacts and soil disruption are a function of project design and construction requirements, and are highly dependent on soil types and topography.

Cumulative impacts on water resources from existing and proposed power plants are discussed in Section 3.17, Cumulative Impacts.

3.1.2.1 Construction

Geology

The construction of the proposed plant facilities, pipelines, and transmission lines is expected to have only minor impacts to geology since most excavation and grading activities would involve only near-surface geologic units. These impacts are addressed in the following section with respect to soils and erosion. Minor impacts to the underlying geologic materials would result from excavation, grading, and any foundation preparation that would require blasting of bedrock.

Soils and Erosion

Generation Plant

Construction activities including excavation, grading and fill placement, and construction traffic would all result in removal or disruption of native soils and vegetative cover. As a result, a localized increase in soil erosion, from both wind and water, would be expected. Also, heavy equipment traffic could result in compaction of near-surface soils, resulting in a reduction in soil permeability and thereby increasing the potential for runoff and erosion.

Erosion and stormwater control measures for construction at the plant site would include the following:

- Best Management Practices (BMPs) would be designed and implemented for all construction activities. These practices include limiting certain construction activities and installing control structures such as sediment traps, diversion ditches, and silt fences. A stormwater pollution prevention plan (SWPPP), to be developed before the start of construction, would provide for limits on the areas to be disturbed, the retention of vegetation where feasible, drainage retention during construction, soil replacement, and native habitat replanting after construction.

- Silt fences, hay bales, and diversion ditches would be sized to handle the 10-year, 24-hour storm. Temporary protection from wind erosion during construction may include the use of spray-on coagulants, flocculants and/or trackifiers. Temporary erosion control measures would remain in place until permanent erosion control measures are established and effective. Seeding mixes would be selected that have been proven to survive in arid environments.
- Clearing, excavation, and grading would be limited to areas absolutely necessary for construction of the plant site facilities.
- To the extent feasible, excavation and grading would be timed to coincide with the dry seasons to reduce the potential for water erosion. Water would be applied, as necessary, to control dust and reduce wind erosion.
- To the extent feasible, slopes would be graded to no steeper than 2 horizontal: 1 vertical.
- Excavated materials would be reused as much as possible. Excess materials would be placed where they would not easily erode, and would not be placed on slopes steeper than 4 horizontal: 1 vertical unless compacted to the meet the requirements for structural fills. Soil stockpiles would be covered with tarps or emulsion and surrounded by silt fences and hay bales, where necessary, to prevent excessive erosion by wind or during rainy periods.
- Disturbed areas would be revegetated by seeding or hydroseeding. Seed mixes would be selected that are known to effectively stabilize erodible soils in arid southeastern Washington. Irrigation or sprinkler systems may be employed to sustain vegetation on bermed areas with high exposure to wind.
- Surface runoff would be directed around and away from cut-and-fill slopes and conveyed in pipes or temporary channels.

The general grading plan for the generation plant site in Figure 3.1-9 was designed to minimize the amount of cutting and filling and thus the volume of material that would be imported or exported from the project site. Detailed grading plans would be developed as part of the final engineering design package.

The near-surface soils on the plant site are generally granular and would support low to moderate bearing pressures without special foundation preparation. These soils are generally suitable for construction of structural fills, provided they are adequately compacted. The underlying basalt bedrock is capable of supporting moderate to high foundation pressures or pile capacities if necessary. Based on current subsurface information, foundations would be constructed by conventional means, and ground improvements other than placement of structural fill are not anticipated to be necessary to support the proposed structures and site improvements.

Although some short-term increase in soil erosion would be expected, implementation of the mitigation measures included in the project design would reduce the potential for significant impacts to soil.

Pipelines

The natural gas and makeup water supply pipeline trenches would be excavated to a depth of 7 to 8 feet to allow at least 5 feet of soil cover over the pipelines. Support for the pipelines would be prepared with conventional trenching and bedding methods.

Trench excavation and heavy equipment operation along the pipeline corridors would destroy or disrupt vegetative cover, result in ground disturbance, and change the density and permeability of the excavated soils. Excess soils would also be generated because of displacement by the pipe and bedding materials and soil bulking. In general, soils near the optimum moisture content expand (bulk) approximately 10% when excavated. Also, without proper backfill compaction, there would be a tendency for the backfilled soils over the pipeline trench to settle over time, potentially creating a pathway for concentration of surface water and resultant erosion by runoff. During construction of the pipelines, and until vegetative cover could be reestablished, there would be a potential for excavated and stockpiled soils to be eroded by water or wind.

In order to reduce potential for post-construction settlement, the trench backfill would be compacted to a density equal to or greater than before the soil it was excavated. Backfill soil would be evenly distributed over the right-of-way to bring the excavated area up to surrounding grade. In addition, there could be excess material generated by removal and replacement of moisture-sensitive soils that cannot be mixed with non-sensitive soils and reused. The excess material would be reused on site, hauled to a location requiring clean fill, or taken to a landfill for disposal. During construction, erosion control and trench stabilization measures would be implemented, although it is likely that some minor soil erosion would occur.

The weight of heavy construction equipment rolling over the trench is normally sufficient to bring the compaction level to as high as 85% relative compaction, depending on moisture content and soil type. In areas where the minimum required compaction could not be achieved by this method, the moisture content would be modified and the soils would be compacted with vibratory compaction equipment. If groundwater were to accumulate in the trench, coarse granular material that is not moisture-sensitive would be used as pipe bedding and/or backfill. At locations where greater than 85% relative compaction would be required, such as road crossings, the trench would be compacted in 6-inch to 1-foot lifts until the backfill is flush with original or finish grade.

Erosion control and stormwater control measures for construction of the pipeline would include the following.

- The top 12 inches of topsoil in the areas of agricultural and native habitat would be removed and preserved for final grade reuse.

- Trench materials would be replaced and compacted to a minimum of 85% of the maximum dry density.
- At road crossings and where water erosion potential is high, the trenches would be compacted in 6-inch to 1-foot lifts to 90% of maximum dry density until the backfill is flush with original or finish grade.
- Excess materials would be stockpiled prior to reuse along the pipeline laterals or at the plant site, and would be protected from wind or water erosion by placement of barriers or use of coverings.
- Debris and soils that are not suitable for backfill would be removed from the pipeline laterals and disposed of at an acceptable location on the project site. Graded areas would be smooth, compacted, free from irregular surface changes, and sloped to drain. Placement of structural fills would be done in layers of uniform, specified thickness. Soil in each layer would be properly moistened to facilitate compaction so as to achieve the specified density. To verify compaction, representative field density and moisture-content tests would be performed during compaction. Structural fill used to support foundations, roads, equipment access areas, etc. would be compacted to at least 90% of the maximum dry density as determined by ASTM D698.
- Embankments, bedding for buried pipe, and backfill surrounding structures would be compacted to a minimum of 90% of the maximum dry density. General backfill placed in remote and/or unsurfaced areas would be compacted to at least 85% of the maximum dry density.
- Some of the soils that would be used for fill are moisture sensitive. The placement of fill consisting of moisture-sensitive soils would be limited to dry weather. If storms occur during construction periods, fill placement would be suspended until the soil can be properly moisture conditioned. A qualified engineer or engineering technician would monitor the fill and backfill placement during construction and would conduct the appropriate field tests to verify proper compaction of the fill and backfill.

Although construction of the pipeline laterals is expected to result in a short-term increase in soil erosion, these mitigation measures would greatly reduce the potential for and magnitude of such an impact. As a consequence, only a low impact to soils from construction of the pipeline is expected.

Transmission Line and Associated Facilities

Permanent or temporary ground disturbance during construction of the transmission line system would occur at the Smiths Harbor Switchyard site, approximately 160 tower sites, about 10 laydown areas, about 12 conductor tensioning sites, and at an unknown number of laydown areas that would not be identified until after a contractor is selected. In addition, clearing and grading would be required for construction of about 11 miles of new access road, 70 to 80 spur roads (each less than 250 feet long), and reconstruction of about 16 miles of existing access roads.

In most instances, this disturbance would result in removal of or damage to vegetation and disruption of soils through site grading and heavy equipment operation. Construction of the switchyard would require grading of an area of about 7 acres, and placement of a large gravel pad. An area of about 0.25 acre would be used for each tower's assembly and erection, and each tower footing (four per tower) would require excavation of up to about 20 cubic yards of soil. The excavated soil would be used as backfill, and the residual soil would be spread along the right-of-way. The cable tensioning sites would each require grading of about 1 acre, and the laydown areas would be expected to occupy several acres each.

The vegetation clearing and soil disruption at the project structures and access roads would result in an increased potential for wind and water erosion of surface soils. Similarly, the operation of vehicles involved in construction during the dry windy months could result in a local increase in wind erosion of soils, whereas operation of vehicles in the wet months could result in increased water erosion and soil compaction. Heavy equipment operation would also result in compacting soils, which could contribute to runoff and erosion.

Construction of transmission line structures or access roads on or near the tops of steep slopes could trigger slope failures, although this hazard would only apply in a few areas along the transmission line right-of-way.

The project would incorporate the following measures to mitigate impacts to soils that could result from construction of the transmission lines, access roads, and appurtenant structures.

- Erosion hazard areas would be avoided wherever possible.
- An erosion and sediment control plan (ESCP) that incorporates BMPs would be developed and implemented.
- Non-essential existing roads and temporary construction access roads would be ripped to break compaction, and restored and stabilized with native vegetation seeding and drainage measures.
- Where necessary based on soil conditions, access roads would be constructed using sound crushed rock as sub-grade and base course.
- Disturbed sites would be reseeded with a seed mixture suited to the site at an optimal time for success.
- Any culverts required for drainage through access roads would be properly spaced and sized to reduce bank erosion, sheet flooding, and impediments to fish passage (if any).
- Cross drains, water bars, rolling dips, ditch armoring, and drain inlets and outlets would be designed and used appropriately to reduce erosion and sheet flooding.
- All existing culverts and stream crossings that pose a risk to riparian, wetland, or aquatic habitat would be improved to accommodate at least a 100-year flood and associated bedload and debris.

- Vegetative buffers would be left along stream courses to reduce erosion and bank instability.
- If required, a SWPPP would be prepared, as required under the National Pollutant Discharge Elimination System (NPDES) General Permit.

The proper implementation of the above mitigation measures would substantially reduce the potential for soil erosion as a result of construction of the transmission lines. While some erosion would be expected to occur, particularly along new access roads and at the switchyard, it would be limited in extent and would likely diminish once erosion control measures were fully established.

Topography and Unique Features

Generation Plant

Impacts to topography at the plant site, including the access road areas, would be limited to grading necessary to establish structural pads and access ways. As shown in the site grading plan (Figure 3.1-9), there would be some modification to the natural site topography. However, the regrading would not result in a modified topography that is radically different from the existing natural topography. Consequently, there would be no significant impact on the plant site topography.

No impacts on unique physical features related to construction on the project site would occur.

Pipelines

Except for temporary disturbance during construction, no impacts to topographic features are anticipated during construction of the makeup water supply pipeline.

Because there are no identified unique physical features along the water supply pipeline, no impact on such features would occur.

Transmission Line and Associated Facilities

Topographic impacts resulting from construction of the transmission lines and switchyard are expected to be limited to site grading for construction of the towers and switchyard, some new access road construction, and reconstruction of some existing roads. These changes would result in topography that closely resembles existing conditions. Therefore, the impacts to topography from construction of the transmission lines and associated structures are not considered to be significant.

No impacts on unique physical features would occur along the transmission line right-of-way.

3.1.2.2 Operation and Maintenance

Geology

Potentially significant geologic and seismic impacts during operation and maintenance include strong ground shaking, liquefaction, lateral spreading and slope instability associated with a major earthquake; frost heave; expansive soils; and subsidence. The most significant hazard with respect to geology is the potential for ground failure in response to a large earthquake. The project would be located within seismic zone 2B of the 1997 Uniform Building Code (UBC). The largest rational and believable seismic event that appears capable of occurring in the region, defined by the UBC as the Maximum Credible Earthquake, is in the range of magnitude 6.5 to 7.0 (USGS 2000). Based on a probabilistic analysis of all potential seismic sources in the region, the peak ground acceleration with 2% probability of exceedance in 50 years is 0.22g (1 g = gravitational force exerted by the earth). The proposed mitigation measures for each major element of the project are discussed in the following subsections.

Generation Plant

Mitigation measures included in the project design to reduce geologic and seismic impacts during operation and maintenance of the generation plant include the following.

- The plant would be designed to reasonably withstand ground acceleration levels that are unlikely to occur over the life of the project. Specifically, project facilities would be designed for magnitude 7 earthquake with a peak ground acceleration of 0.22g. This design standard primarily affects the foundation and structural steel specifications for buildings, the HRSG structure, combustion gas turbine-generator foundations, steam turbine-generator foundations and supports, cooling tower basins and structures, HRSG stacks, and large tank foundations and design.
- Slopes requiring soil reinforcement to resist seismic loading would be reinforced with geo-grid for fills and soil nailing for cuts.
- Detailed geotechnical studies indicate that although the site is underlain with soils that are highly vulnerable to liquefaction when saturated, the average factor of safety against liquefaction is 1.28. In areas where there is a greater risk of liquefaction, special foundations would be used to eliminate the potential for liquefaction. Design options for these areas include complete over-excavation and recompaction of all soils above bedrock, dynamic compaction of the soils in place, or support on driven piles. For any of these foundation support options, the risks associated with liquefaction would be mitigated.
- Visual inspection would be conducted following perceptible seismic activity. Inspectors would look for signs of incipient mass movements in those areas identified as potentially susceptible to such failures.
- Periodic inspections and evaluations of high-energy components would be performed to ensure mechanical integrity and to satisfy insurance underwriting requirements.

- Extensive engineering and operational analyses would be completed for systems using hazardous chemicals. Risk management plans would be developed for those systems.

Based on the design and implementation of the above mitigation measures, the impact to the project from the potential seismically induced ground failure and strong ground motion associated with the Maximum Credible Earthquake would not be significant.

Pipelines

As with the plant site, there is a potential that the water pipeline and natural gas pipeline would be subjected strong ground shaking associated with the Maximum Credible Earthquake. Therefore, the pipelines would be designed and constructed in accordance with the seismic guidelines of the prevailing design standards. The design would incorporate measures to reasonably enable the pipeline to withstand the ground accelerations associated with this event.

The pipeline route is situated within loose granular soils that would be highly susceptible to liquefaction if they were saturated at the time of a large earthquake. Although geotechnical investigations along the pipeline routes have not been performed, water level measurements from wells in the area suggest that groundwater is sufficiently deep that liquefaction would not be likely along the pipeline.

The proposed pipelines would not cross or approach any slopes that would be susceptible to failure in response to seismic loading.

Visual inspection would be conducted following perceptible seismic activity. These inspections would look for signs of incipient mass movements or leakage.

Based on the current understanding of soil and groundwater conditions the potential for impacts to the water pipelines and the natural gas pipeline from geologic hazards is considered to be low. However, if soil or groundwater conditions are found to differ from those expected, additional foundation preparation below the pipe may be required to mitigate the hazard. This would be particularly important for the natural gas pipeline because of the considerable hazard that could result from a rupture of that pipeline.

Transmission Line and Associated Facilities

Geologic hazards that could impact the transmission line right-of-way are all associated with the stability of the structures. Hazards to the towers and the switchyard could include strong ground motion and resultant ground failure, subsidence, expansive soils, or slope failure. Although impacts to the transmission line system from seismicity or inadequate foundations would not likely pose an environmental impact, they could result in an increased requirement for maintenance or reconstruction. This would, in turn, have the same potential impacts, although on a smaller scale, as the original construction. The potential for these impacts could be mitigated to low levels by the design and construction of all project structures to meet expected design requirements, including ground accelerations and wind loads.

Mitigation measures that are included within the project design include

- design of all structures to reasonably withstand ground motions associated with the Maximum Credible Earthquake;
- siting of structures to avoid unstable slopes or difficult soil conditions wherever possible;
- design of foundations to accommodate undesirable soil conditions where necessary; and
- periodic inspection and maintenance of all structures to identify and correct progressive adverse geologic processes before they pose a risk of failure or significant environmental impact.

Based on these mitigation measures included within the project design, combined with the relatively low environmental impact that would result if a component of the transmission system were to fail, the potential for geologic hazards to impact the transmission lines is considered to be low and insignificant.

Soil and Erosion

Most soil erosion impacts would occur during construction of the generation plant, pipelines, and structures along the transmission line right-of-way. Mitigation measures implemented during construction (discussed in Section 3.1.2.1) should effectively control most soil erosion over the life of the project. Other mitigation measures that would pertain specifically to the long-term control of soil erosion are discussed in the following subsections.

Generation Plant

Stormwater detention ponds constructed for power plant operations would be sized to contain the 100-year rainfall event of 1.8 inches in a 24-hour period. The two stormwater detention ponds would cover approximately 2.2 acres. Water from the power plant proper would be collected and diverted through oil/water separators and then to a lined pond for reuse on-site. Stormwater from the area external to the power plant proper would be collected and diverted to an unlined pond for evaporation and percolation to groundwater.

During ongoing operations, routine maintenance and inspection activities would include project site inspections and compliance management of the SWPPP, landscaping plan, and erosion control plan (until permanent erosion control features are established).

Pipelines

The pipelines would traverse stabilized and partially stabilized dune lands. However, active dune lands, if locally present along the pipeline laterals, would be susceptible to simultaneous erosion and accretion as the dunes shift in shape and location. A few ephemeral drainages would also be crossed where major rainfall events could result in erosion or accretion around the pipeline.

Deposition and accretion of dune landforms would not affect the integrity of the buried pipelines. However, deflation or erosion may expose portions of the buried pipelines if there is not sufficient surveillance and maintenance. Wallula Power Project personnel would perform regular surveillance of the makeup water supply pipeline to identify and repair soil erosion and accretion resulting from dune migration. GTN, as the owner and operator of the natural gas pipeline, would provide regular surveillance of the natural gas pipeline.

The pipelines would be designed and constructed to reduce risks to the project from soil subsidence, liquefaction, frost heaving, and soil expansion. As a result of commitments to safe design and long-term maintenance included within the project description, adverse impacts from subsidence and liquefaction of soils are considered unlikely during the life of the project.

Transmission Line and Associated Facilities

No significant soil erosion impact would be expected as a result of operation and maintenance of the transmission right-of-way. Once the erosion controls implemented during project construction were established, activities associated with the operation and maintenance would not likely result in any significant impacts from soil erosion. Ongoing activities that could result in erosion would primarily involve vehicular traffic and minor local disturbance of soils when maintenance activities were required along the right-of-way. These activities would not produce impacts beyond those produced during construction.

Periodic inspections and maintenance would be performed to evaluate whether erosion controls are functioning as designed. Corrective measures would be taken as necessary to minimize soil erosion.

Topography

No impacts on topography have been identified as a result of the operation and maintenance of the generation plant, pipelines, or transmission lines.

3.1.3 Impacts of Alternatives

3.1.3.1 Alternative Transmission Structure and Longer Span Design

This alternative would entail construction of transmission towers that are 165 feet high rather than the 145-foot height specified in the project description. This alternative design would have an average span distance of 1,500 feet rather than 1,150 feet. This would eliminate the need for construction of approximately 17 towers, or roughly 10% of those that would otherwise be required for the project. This would, in turn eliminate the need for a comparable percentage of the spur roads that would be required for construction and maintenance of the towers.

Potential advantages of this alternative include the following.

- A reduction in the number of structure locations would reduce the required surface disturbance associated with constructing the towers. This alternative would eliminate any potential for impacts at about 17 locations and reduce the overall potential impact of soil erosion associated with construction and maintenance of the transmission lines.
- Fewer access roads would be required, thereby reducing the overall amount of soil disturbance and potential for erosion.
- The construction period would be shortened, thereby reducing the number of vehicle trips required along access roads and reducing the potential for resultant soil compaction and erosion along the roads.
- The longer spans would provide greater flexibility in avoiding areas that are sensitive to erosion, most notably where Juniper Canyon is crossed.

No potential disadvantages of this alternative have been identified with respect to geology, topography, soils, and erosion.

3.1.3.2 Alternative Alignment near McNary Substation

There would be very little difference in impacts to soils, geology, or topography between these two options for entry into McNary Substation. A similar number of transmission towers and access roads would be required for either alternative.

3.1.3.3 No Action Alternative

The No Action Alternative would result in no impacts to geology, soil topography, unique features, or erosion because the project would not be constructed and site conditions would remain unchanged. However, because the site is zoned for industrial use, it could be developed in the future for a different industrial project.

3.1.4 Mitigation Measures

As discussed earlier, the proposed project includes numerous elements to mitigate environmental impacts to the site geology, soils, topography, and erosion, both during construction and operation of the facility, pipelines, and transmission lines (see also Appendix A). The following additional mitigation measures address environmental impacts that are not included in the Application for Site Certification.

3.1.4.1 Construction

Generation Plant

It is likely that no additional mitigation measures would be required to reduce geological impacts from the construction of the proposed generation plant. However, in the event that it is necessary to over-excavate areas of liquefaction-susceptible soils, the erosion control plan may need to be revised to establish measures to protect relatively large cut slopes and minimize soil erosion. Similarly, measures would have to be developed to properly handle and dispose of water generated during dewatering if additional excavation was required to remove liquefiable soils.

Pipelines

Provisions should be established for handling and disposal of contaminated soils or materials that could potentially be encountered in trench excavations.

Transmission Line and Associated Facilities

Once the preliminary tower sites have been determined, each site would be inspected to evaluate site-specific erosion potential. Adjustments will be made, wherever possible, to site the towers where the potential for erosion and sedimentation is reduced.

Prior to final design and construction, site-specific geotechnical evaluations of tower sites would be conducted to evaluate foundation suitability and construction issues. Special attention would be given to evaluating tower foundations and the stability of the adjoining areas in the vicinity of the Walla Walla River, Spring Gulch, and Juniper Canyon crossings.

Compaction standards should be established for backfill of tower footings to reduce the potential for erosion to result from improperly placed fill. Appropriate standards should also be established for placement and compaction of excess soil elsewhere along the right-of-way to mitigate for potential soil erosion.

Prior to construction, suitable waste areas for depositing and stabilizing excess soil and rock should be identified.

Construction-related activities should be minimized on the slopes adjoining the Walla Walla River, Spring Gulch, and Juniper Canyon to reduce the potential for increased slope instability, erosion and sedimentation, and the potential for accidental releases of fuels, lubricants, or other hazardous substances.

In addition to requiring construction contractors to conduct refueling operations in areas where a spill or release is not likely to pose a serious environmental concern, rigorous spill prevention and cleanup measures should be established for all construction activities.

3.1.4.2 Operation and Maintenance

Generation Plant

No additional mitigation measures would be required to reduce impacts during operation and maintenance of the proposed generation plant.

Pipelines

A geotechnical investigation of the pipeline alignments should be conducted to identify areas that are susceptible to wind erosion and to evaluate foundation conditions with respect to their seismic stability and liquefaction potential. This would be particularly important for the natural gas pipeline because of the serious hazard that could result from a break in the pipeline.

Owing to the potential for exhumation of the pipelines by wind erosion along the pipeline corridors, an inspection program should be established to check on the integrity of the pipelines. This should include revegetation, regularly scheduled inspections, increased scrutiny during periods of persistent high winds, and maintenance to mitigate erosion before it becomes severe.

Transmission Line and Associated Facilities

No further mitigation measures required.

3.1.5 Significant Unavoidable Adverse Impacts

The project site would be removed from productive agricultural use for the life of the project. The tree farm land currently owned by Boise Cascade, which would be acquired in order to obtain water rights, would also be removed from agricultural use for the life of the project. In the latter case, there is a potential that taking the agricultural lands out of production could result in an increase in soil erosion or potentially in destabilization of currently inactive dunes. This potential for soil erosion would be mitigated, in part, by returning the area to natural conditions by replanting with native species. However, without irrigation it is likely that this revegetation would not be as protective as current conditions. Consequently a small increase in erosion potential would likely be unavoidable, but would not likely be significant. These impacts presumably could not be completely mitigated by irrigation because the water would be required for the generation plant.